Vol. 107 No. 10 May 17, 1947

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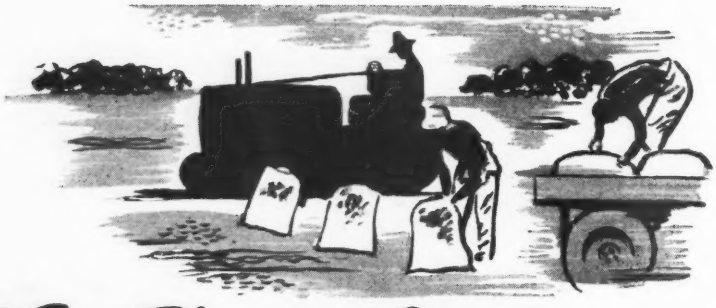

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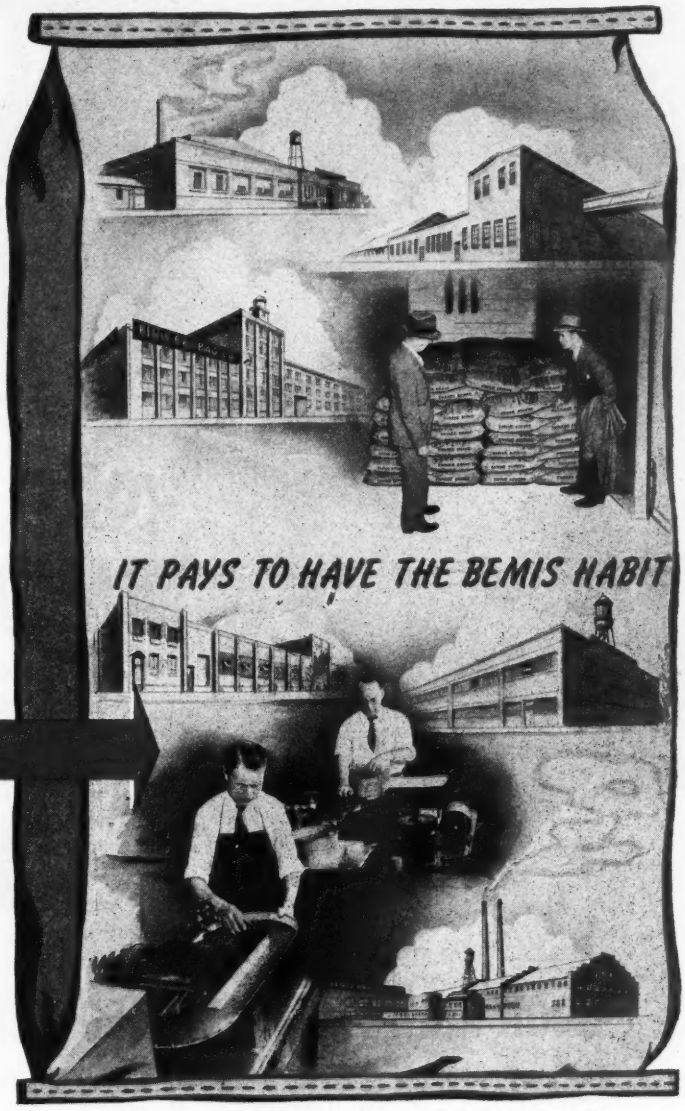

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The American FERTILIZER

Vol. 106 MAY 17, 1947 No. 10

The Problem of Filler in Fertilizers*

By A. L. MEHRING[1]

Introduction

The cost of plant food to the farmer can be lowered by increasing the plant-food content of mixed fertilizers. This laudable objective can be attained by reducing the use of unnecessary filler or by employing higher-analysis materials.

The use of filler in fertilizer is generally condemned by the public. The condemnation probably results however, from the connotations associated with the word "filler" and from a lack of knowledge of the problems involved in the formulation, manufacture, sale, and use of mixed fertilizers. Within certain limits the public's attitude is justified and the use of unnecessary filler should be condemned. It is desirable, however, that the public should have a clear understanding of the problems associated with the use of filler in the manufacture of mixed fertilizers. The problems are in part technological, agronomic, educational, and economic. It is the purpose of this paper to analyze the functions of filler, to discuss the problems involved in its use, and to point out ways in which it is believed some of them can be solved.

Definition of Filler

In the broad sense of the word, filler is any material added to mixed fertilizer that contains little or no available nitrogen, phosphoric acid, or potash. Thus the word covers not only such valueless materials as sand, but also manganese sulphate and dolomite, which when properly employed, serve useful purposes.

The erroneous statement is sometimes made that fertilizers contain 20 per cent plant food and 80 per cent filler. In order to show conclusively what mixed fertilizers really do contain, Lundstrom and Mehring (*2*)** analysed 44 samples collected in 16 states. The average chemical composition of 27 selected complete fertilizers representative of U. S. conditions in 1935 is as follows:

Constituent	*Per cent*
Ammonia, NH_3	2.76
Lime, CaO	16.38
Magnesia, MgO	.78
Potash, K_2O	5.36
Soda, Na_2O	4.08
Alumina, Al_2O_3	.58
Copper oxide, CuO	.006
Iron oxide, Fe_2O_3	.80
Manganese oxide, MnO	.024
Zinc oxide, ZnO	.022
Boric oxide, B_2O_3	.012
Carbon dioxide, CO_2	1.05
Chlorine, Cl	5.86
Fluorine, F	.70
Nitric oxide N_2O_5	1.62
Phosphoric oxide, P_2O_5	9.87
Sulphuric oxide, SO_3	20.04
Soluble organic matter	.68
Protein	3.94

* A paper presented at the Fertilizer Conference held at Beltsville, Md., January 8 and 9, 1947.

[1] Senior Chemist, Division of Soils, Fertilizers and Irrigation, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Maryland.

** Italic numbers in parentheses refer to Literature Cited at end of article.

Constituent	*Per Cent*
Other organic matter	5.58
Water of constitution	3.58
Moisture	4.90
Acid insoluble matter	12.95
Total	101.574
Less oxygen equivalent of halogens	1.617
Corrected total	99.957

Miscellaneous determinations	*Per cent*
Ammoniacal, N	2.27
Nitrate, N	.42
Insoluble, N	.63
Soluble organic, N	.34
Total N	3.66
Water-soluble, P_2O_5	5.14
Citrate-soluble, P_2O_5	4.10
Insoluble, P_2O_5	.64
Total P_2O_5	9.88
Loss on ignition	25.60
Total water-soluble salts	45.31

From these chemical determinations the following substances appear to have been present in the proportions shown:

Substance	*Per cent*
Calcium sulphate	18.62
Calcium phosphates	16.83
Organic matter	9.52
Ammonium sulphate	7.14
Sodium chloride	5.06
Potassium chloride	4.75
Potassium sulphate	4.34
Ammonium phosphates	3.15
Sodium nitrate	2.55
Aluminum sulphate	1.94
Iron sulphate	1.90
Calcium fluoride	1.44
Sodium sulphate	1.06
Magnesium chloride	.72
Calcium cyanamide	.70
Urea	.07
Zinc sulphate	.06
Manganese sulphate	.05
Borax	.03
Copper sulphate	.02
Moisture	4.90
Dolomite	2.20
Acid insoluble	12.95
Total	100.00

Of the substances shown above, the calcium phosphates, calcium, iron, and aluminum sulphates, and calcium fluoride are essential parts of superphosphate and cannot be removed without prohibitive cost. Similarly the sodium chloride, sodium sulphate, and magnesium chloride are impurities in nitrate of soda and potash salts. The moisture cannot be considered as filler, for although it can be removed by heating, the mixture will absorb moisture again from the air until about the same amount is present. The 12.95 per cent of material insoluble in strong hydrochloric acid is undoubtedly largely sand.

Of all the substances found, only about 12 per cent, or the sand, and probably a small part of the organic matter can be properly classed as useless filler. The others are sources of primary, secondary or minor element nutrients or necessary impurities of the commercial materials customarily used to make such mixtures. Elements in combination with the essential nutrients cannot be classed as filler.

The statistics presented in this paper classify filler as follows: (1) Materials added to correct the acidity of fertilizers or to supply secondary or minor plant food elements; (2) Organic conditioners; and (3) Other filler of little or no value.

Functions of Filler

Filler has been used to reduce run-of-pile superphosphate, which contains about 19 per cent P_2O_5 to 16 or 18 per cent grade, and 60 per cent muriate of potash to 50 per cent grade, as well as for other similar purposes. The remainder of this paper, however, will be confined to its use in fertilizer mixtures.

Filler may be added to mixed fertilizers for one or more of the following reasons; (1) As "make weight" to balance out the formula to an even grade; (2) As a "conditioning agent" to reduce caking and improve the drillability of the fertilizer; (3) To correct the physiological or potential acidity of fertilizers; and (4) To supply secondary or minor element nutrients. The latter two uses may be conveniently considered together as will be seen presently.

"Make Weight" Material

In formulating a complete fertilizer a manufacturer usually includes at least four and sometimes as many as ten or more fertilizer materials in the formula. He has a choice of other materials, depending on market conditions. Seldom is it practicable to obtain the exact quantities of the three major plant foods desired in a ton by use of only the fertilizer materials themselves. For example, suppose it is desired to make one ton of physiologically neutral 4–12–4 fertilizer. This will contain, 80 pounds of nitrogen, 240 pounds of phosphoric acid, and 80 pounds of potash.

The following formula of widely used and satisfactory materials will supply these quantities and the resulting fertilizer will be physiologically neutral:

Material	*Grade*	*Pounds*
Superphosphate....	20	1200
Ammonia solution..	40	100
Ammonium sulphate.	20.7	194
Muriate of potash..	60	133
Dolomite.....		285
Total.....		1912

The total is only 1912 lbs. In a case like this 88 pounds of filler is added to give the desired analysis instead of marketing a fertilizer analyzing 4.2–12.6–4.2. In some parts of the country the use of dolomite in making a 4–12–4 would be undesirable. If this were left out, one would have to add 373 pounds of filler or go to a higher analysis grade. The next higher grade with the same plant-food ratio is 5–15–5. This can be prepared economically in a number of ways, one of which is as follows:

Material	*Grade*	*Pounds*
Double superphosphate.....	45	100
Superphosphate....	19	1342
Ammonia solution..	40	150
Ammonium sulphate	20.5	195
Muriate of potash..	60	167
Total.....		1954

Again it becomes necessary to add a small quantity of filler to make the formula add up to an even ton, or to change the formula to some other combination of materials. The use of not to exceed 100 pounds per ton of filler for this purpose seems justified, because fractional guarantees are not permitted under most State fertilizer control laws. Furthermore, standardize l fertilizer grades usually vary from each other by two per cent or more in the content of one plant-food. When the fertilizer ingredients of suitable grade become generally available and economic, the lower analysis mixtures should be replaced by higher analysis preparations having the same plant-food ratio, for example, 5–10–5 or 6–12–6 instead of 4–8–4. Even so, as in the foregoing example, the use of some filler is usually necessary.

Conditioning Agent

Formerly, mixed fertilizers contained large quantities of low-analysis organic materials which helped to prevent caking on storage and generally to maintain satisfactory physical properties. For several reasons, including limited supplies and high costs, the use of organics has now been reduced to the point where many fertilizers are essentially mixtures of inorganic materials. At the same time, as the result of mechanization of fertilizer distribution on the farm, the standards, for physical condition, have become higher. Great advances have been made in improving the physical properties of inorganic fertilizers but the use of a limited quantity of "organic conditioning agent" is often essential to maintain satisfactory physical standards. This Bureau and the Eastern States Farmers' Exchange — a large producer of high-analysis fertilizers— have cooperated in the investigation of this problem for a period of years, and have concluded that in order to maintain good drillability it is necessary to use about 100 pounds of "organic conditioner" per ton in many grades of mixed fertilizer. Until mixed fertilizers can be economically granulated, the use of some organic conditioning agent will be essential in many instances.

A given filler obviously may function simultaneously as a conditioning agent and as a "make-weight" material. The most commonly used materials that serve these two purposes are dried humus or peat and such waste products as peanut hull and cocoa shell meals.

Neutralization of Acidity

Low-cost nitrogen fertilizer materials used in the manufacture of mixed fertilizers tend to aci lify the soil. The use of these materials increased rapidly in the 1920's so that the equivalent acidity of the average mixed fertilizer sold in the United States increased from 20 pounds of calcium carbonate per ton in 1920 to 152 pounds in 1933 (*4*). As a result of this development, agronomists and control officials advocated the incorporation of basic materials, mainly dolomitic limestone, in mixed fertilizers to an extent that would correct the potential acidity. A number of States, particularly in the Southeast, now require a guarantee as to the equivalent acidity or basicity of mixed fertilizers sold in the State. As a result the equivalent acidity of the average fertilizer sold in the United States dropped to 19 pounds of calcium carbonate per ton in 1936. The use of dolomite, limestone, and other basic materials in mixed fertilizers increased from 34,000 tons in 1929 to 302,000 tons in 1936 and 500,000 tons in 1945. These materials, when used in proper proportions for the conditions under which the fertilizer will be used, do perform a useful function in correcting

acidity and also supplying secondary plant food elements, such as calcium and magnesium.

It is recognized by agronomists and the fertilizer industry that the use of limestone in mixed fertilizers is a relatively expensive way for farmers to secure liming material. The ideal situation is for the farmer to purchase such material in bulk at a much lower unit cost. It will, however, probably be advisable to incorporate dolomitic limestone in mixed fertilizers that are to be used at high rates per acre on the lighter textured acid soils of the Atlantic and Gulf Coast States until most of the farmers in these regions have an adequate liming program.

Trends in the Use of Filler

The trends in the use of filler in fertilizers for the period 1900 to 1941 have been shown in previous papers (*6*, *7*, *8*). Table 1 summarizes the essential data with some new information added. In this table peat and peanut hulls stand in a separate class, called "organic conditioners," rather than, as in the previous papers, with the natural organics that supply available plant food.

In 1900 fertilizers contained 7.7 per cent filler. This was used as a make-weight material to balance out the analysis. In the interval from 1900 to 1930 the proportions of plant food in the average material included in the chemical nitrogen, phosphate and potash groups grew slowly but steadily. In 1900, 91 per cent of the nitrogen came from the lowest total plant-food group, the natural organics, but in 1930 only 20 per cent. During this period the plant-food content of fertilizers increased from 13.9 to 17.8 per cent. But the weighted average of the plant-food supplying materials increased from 15.1 to 20.6 per cent. Therefore the plant-food content of the available materials grew faster than that of the mixtures made from them. The use of filler increased to 13.5 per cent of the average mixture, and 81 per cent of the filler was inert material.

TABLE 1.
SUMMARY OF DATA RELATING TO USE OF FILLER IN MIXED FERTILIZERS

Class of Material	1900	1910	1920	1930	1940	1945[1]
	%	%	%	%	%	%
Plant-food Content of Classes of Materials Used						
Chemical nitrogenous	16.6	17.6	17.5	20.3	25.4	25.3
Natural organics	11.7	11.2	11.2	11.3	8.8	8.5
Phosphates	14.8	15.8	16.3	18.9	20.8	19.7
Potash	24.4	23.6	23.2	32.6	50.9	52.7
Fillers in Mixed Fertilizers						
Limestone, etc.[2]	0.1	0.1	0.2	1.2	7.2	6.8
Organic conditioners[3]	1.0	1.0	1.5	1.4	1.5	.8
Inert filler[4]	6.6	8.0	12.1	10.9	12.3	6.8
Total	7.7	9.1	13.8	13.5	21.0	14.4
Plant-food Content of Mixed Fertilizers						
As sold	13.9	14.8	13.9	17.8	19.6	21.5
Without any filler[5]	15.1	16.1	16.1	20.6	24.8	25.1
With no inert filler[6]	15.0	16.0	15.9	20.3	23.1	23.5

[1] Preliminary.
[2] Including all secondary and minor element materials used.
[3] Peat, peanut hulls, etc. In other words those organics that do not supply significant quantities of available plant food.
[4] Sand, soil, coal ashes, etc.
[5] What it would have been if no filler whatever had been used.
[6] Assuming the limestone, magnesia, gypsum, manganese sulphate, borax, organic conditioners, etc. were included and only such materials as sand and coal ashes eliminated.

In the period 1930 to 1940, the average plant-food content of materials, especially chemical nitrogen and potash, increased rapidly as shown in the upper part of Table 1. This indicates that high-analysis materials are promptly adopted and extensively used by manufacturers when available at satisfactory prices per unit of plant food. Unfortunately, just as earlier, the nutrient content of mixed fertilizers did not keep pace with that of the ingredients. As a result mixed fertilizers in 1940 contained 21.0 per cent filler. In this period dolomitic limestone came into general use, as shown in detail elsewhere (*4*), and consequently the proportion of inert material was reduced to 59 per cent of the total filler.

During the war, demand for fertilizers increased so rapidly that supplies of raw materials could not keep up. Consequently a tendency developed in some quarters to keep fertilizer analysis grades low in order to make more tons of mixed fertilizer from a limited quantity of materials. Despite this, progress in up-grading fertilizer has been accelerated and the use of filler materially reduced. All but a few grades of mixed fertilizers containing less than 20 units of plant food have been eliminated, as well as the 16-per cent grade of superphosphate. The percentage of total filler was reduced from 21 to 14.4 and inert filler was only 47 per cent of all filler. This situation contrasts sharply with that during the First World War when the average plant-food content of fertilizers dropped from 15.5 per cent in 1914 to 13.5 per cent in 1918. Further progress in increasing the plant-food content of fertilizers and reduction in the use of filler is anticipated when fertilizer materials are again in free supply. The bottom section of the table indicates what could have been accomplished in the past. The present aver-

(Continued on page 26)

Western Phosphate Rock Industry in 1947

New high records both for quantity and value of marketed production highlighted the Western States phosphate rock industry in 1946, as reported by producers to the Bureau of Mines, U. S. Department of the Interior. Marketed production jumped from 274,198 long tons in 1945 to 492,602 tons in 1946, an increase of 80 per cent. The value nearly doubled—rising from $1,589,915 in 1945 to $3,012,157 in 1946. The output in 1946 came from Idaho, Montana, and Utah; Wyoming was inactive.

A record marketed production of Idaho phosphate rock in 1946 (312,658 long tons)—more than double the previous record made in 1945 (123,340 tons)—made that State the leading producer in the Western region. There were only two companies in Idaho reporting sales of phosphate rock in 1946. The larger producer, the San Francisco Chemical Company, 216 Pine St., San Francisco 4, Calif., operated its Waterloo Mine, near Montpelier, Bear Lake County, Idaho, during 1946, selling the rock produced both in the export and domestic markets, but not consuming any of its production in its own California plant. The other company—the Anaconda Copper Mining Co.,—operated its mine at Conda, Caribou County, Idaho. The shipments went largely, as in prior years, to the company's plant at Anaconda, Montana, for conversion to superphosphate and phosphate chemicals. A considerable quantity was sold to other domestic consumers. None was exported. The Simplot Fertilizer Company, Pocatello, Idaho, produced a large quantity of phosphate rock from its Fort Hall mine in Bingham County, near Fort Hall, but retained it in stock, using purchased material for its superphosphate operations. The Teton Phosphate Company, Montpelier, Idaho, made no shipments in 1946, and did only development work at its mine near Montpelier during the year.

Montana, the leading phosphate rock producer of the Western States for several years, dropped to second place in 1946. Its marketed production in that year—179,944 long tons—exceeded that of 1945—150,858 tons—,however. Shipments were made by three companies. The Montana Phosphate Products Co., of Trail, British Columbia, the largest producer in Montana, operated its Anderson, Anaconda, and Graveley mines as well as several Government leases in the Garrison district, Montana. Most of the mined product was exported to the plant of the parent company, the Consolidated Mining and Smelting Co., of Canada, Ltd., at Trail. Only a small quantity was sold in the United States. The Manganese Products, Inc., 4260 West Marginal Way, Seattle 6, Washington, shipped a small quantity of phosphate rock from the Philipsburg district, Montana, in 1946. Lee H. Skeels, trustee and leasee of the Soluble Phosphates, Ltd., Maxville, Granite County, Montana, mined a small tonnage at a mine near Maxville, and shipped the product for direct application to the soil. The Moonlight Mining Co., Maxville, Montana, operating a property near Princeton, Montana, is reported to have made a small shipment of phosphate rock in 1946. The International Minerals & Chemical Corporation mined on its property in the Douglas Creek area, Granite County, Montana, for about two months in 1946, but did not ship any phosphate rock from its lease during the year.

(Continued on page 26)

WESTERN STATES PHOSPHATE ROCK SOLD OR USED BY PRODUCERS, 1942–46

	Idaho			Montana		
	Long	Value at mines		Long	Value at mines	
Year	tons	Total	Average	tons	Total	Average
1942.....	114,079	$ 511,249	$4.48	150,402	$ 572,464	$3.81
1943.....	108,916	561,630	5.16	119,764	488,665	4.08
1944.....	112,565	584,400	5.19	186,434	761,745	4.09
1945.....	129,340	673,627	5.46	150,858	916,288	6.07
1946.....	[1]312,658	[1]1,805,103	[1]5.77	179,944	1,207,054	6.71

	Utah			Total		
	Long	Value at mines		Long	Value at mines	
Year	tons	Total	Average	tons	Total	Average
1942.....	1,184	7,410	$6.26	265,665	$1,091,123	$4.11
1943.....	.....	.....	....	228,680	1,050,295	4.59
1944.....	.....	.....	....	298,999	1,346,145	4.50
1945.....	.....	.....	....	274,198	1,589,915	5.80
1946.....	[2]	[2]	[2]	492,602	3,012,157	6.11

[1] Includes a few thousand tons produced in Utah.
[2] Included under Idaho.

THE AMERICAN FERTILIZER
ESTABLISHED 1894
PUBLISHED EVERY OTHER SATURDAY BY
WARE BROS. COMPANY
1900 CHESTNUT ST., PHILADELPHIA 3, PA.

A Magazine international in scope and circulation devoted exclusively to the Commercial Fertilizer Industry and its Allied Industries

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C. A. WHITTLE, Associate Editor
K. F. WARE, Advertising Manager

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Another National Fertilizer Bill

The fertilizer industry is once again summoned to action to resist the attempts of left-wing Congressmen to put the government in the fertilizer manufacturing business. After a respite of a few weeks following the shelving of the Flannagan Bill (H.R. 2494) by the House Committee on Agriculture, a new threat has appeared in a bill (S. 882) introduced in the Senate on May 8th by 10 Senators, which contains practically all the objectionable features of the Flannagan Bill. On May 12th, Representative Flannagan introduced into the House a new bill (H.R. 3421) which is identical with the proposed Senate measure, and which is apparently intended to replace his former bill.

The American Farm Bureau Federation and backers of this socialistic legislation have shown finesse in having the new bill sponsored by Senators from 10 important agricultural States: Capper, Kansas; Thye, Minnesota; Stewart, Tennessee; Aiken, Vermont; Bushfield, South Dakota; Young, North Dakota; Wilson, Iowa; Hichenlooper, Iowa; Wherry, Nebraska; Hill, Alabama. It is also significant that the first seven of these are the chairman (Capper) and six members of the 13-member Committee on Agriculture.

The bill includes the construction of the Mobile, Ala., fertilizer plant, together with the acquisition of phosphate and potash reserves. The nation-wide fertilizer experimental program is retained by which fertilizer would be supplied to not more than two per cent of the farms of each State for demonstration purposes. Loans are also authorized to farmer cooperatives for the acquisition or construction of fertilizer plants, and an olive branch is held out to the fertilizer industry by the inclusion of a provision authorizing the Reconstruction Finance Corporation to make loans to fertilizer companies on terms similar to those for cooperatives.

The bill is a perfect example of unnecessary and undesirable legislation. The U. S. Department of Agriculture and the State Agricultural Experiment Stations are constantly conducting every conceivable form of fertilizer demonstration, and through their literature, extension service and county agents, our farmers have available the world's most complete information on soil practices and conservation.

There is no need to pick one farmer out of fifty (with its possible political implications)

to show what can be accomplished by the proper use of fertilizer.

As to the ability of the fertilizer industry to supply the country's needs for this product, the figures on 1946 production supply the answer. During the past year, 14,900,000 tons were manufactured and sold—a total more than twice the average annual consumption in the 1935–1939 period, and 13 per cent higher than in 1945, the previous all-time peak.

Many years ago, a statesman said, "Eternal vigilance is the price of liberty." If the industry is to remain free to continue, under private enterprise, the progress they have made over the past decades, every member must continue his efforts to see that his Representatives and Senators are kept supplied with the true picture of the present fertilizer situation.

V-C to Add to Charleston Plant

The Virginia-Carolina Chemical Corporation is increasing its plant facilities for the manufacture of phosporic acid and superphosphates at its Charleston, S. C. factory. The Chemical Plants Division of Blaw-Knox Co., Pittsburgh, Pa. has received the contract for construction and the design and erection of the necessary processing equipment. Work is scheduled to begin during the present month.

American Potash and Chemical Announce Prices

The American Potash and Chemical Corporation has announced prices for the fertilizer year from June 1, 1947 to May 31, 1948. For muriate of potash, 60 per cent K_2O minimum, in bulk, carload lots, the list price is quoted as 45.5 cents per unit K_2O, f.o.b. Trona, California. The company reserves the right to adjust this price to meet the competition of any other producer of muriate. The list price ex-vessel basis has been discontinued.

The customary seasonal discounts have been continued: 8 per cent for monthly shipments from June, 1947 to March 1948, inclusive, with an additional 4 per cent upon completion of the contract; 4 per cent for monthly shipments from October, 1947 to March, 1948 inclusive, with an additional 2 per cent upon completion of the contract.

International Building New Acid Plant in Ohio

Construction has begun on a new plant for the manufacture of contact sulphuric acid by International Minerals & Chemical Corporation as an addition to its fertilizer and acidulating plant at Lockland, Ohio.

The contract for the new plant has been let to the H. K. Ferguson Company of Cleveland, Ohio, and construction is expected to be completed in time for operations to begin by the first of next year. The new building will be a compact, modern unit measuring approximately 100 by 170 feet with an annual capacity of 45,000 tons.

Output of the new plant is expected to supply the necessary sulphuric acid to the adjacent fertilizer plant as well as for other general chemical uses. The additional sulphuric acid will enable the fertilizer plant to increase its output substantially, inasmuch as acid was in short supply during the past year.

Murphy Elected American Potash and Chemical Director

William J. Murphy, Vice-President in Charge of Sales for the American Potash & Chemical Corporation, has been elected to the company's board of directors. Mr. Murphy has been with the company since 1913.

Employment in the Fertilizer Industry

An analysis of employment data of the U. S. Bureau of Labor Statistics has been made by the National Fertilizer Association. The increase in fertilizer production has been made possible by hiring more workers and by working longer hours. The average number of wage earners in the fertilizer industry rose from 18,800 in 1939 to 24,000 in 1946. The average work week was 35.8 hours in 1939, 45.1 hours in 1945, and 42.2 hours in 1946.

Payrolls rose more sharply during the war than did the number of workers, the total for 1946 being about three times that of 1939. Average weekly earnings increased from $14.71 in 1939 to $32.92 in 1946. While the costs of living have increased during those years, the Bureau of Labor Statistics figures that the purchasing value of the average weekly wage during 1946 was 60 per cent better than in 1939. The labor cost per ton increased 60 per cent over 1939.

St. Regis Opens Louisville Sales Office

The St. Regis Sales Corporation (New York) has announced the opening of a multiwall paper bag sales office in Louisville, Ky., under the supervision of Charles C. Keefer.

This office, operating within the Central Sales District which has its headquarters in Chicago, brings to 22 the number of offices which St. Regis maintains throughout the country for the sale of heavy duty paper bags to the rock products, food, feed, chemical and fertilizer industries. The Louisville office will be located at 318 Martin Brown Building.

Link-Belt Announces New Concentric-Action Screen

A new Vibrating Screen, to be known as the Link-Belt "CA" Concentric-Action Screen is announced by Link-Belt Company as now being available, to meet a constantly-growing demand for economical and effective sizing of a large variety of materials.

The new "CA" Screen is an inclined floor-mounted or spring-and-cable suspended screen with an ingeniously balanced two-bearing vibrator mechanism which imparts a concentric or circular vibrating motion to all points of the screening surfaces.

The screen can be used for both medium and heavy duty sizing as well as for scalping and dewatering or rinsing operations.

It is made with double or triple decks and in sizes ranging from 3 x 8-ft. to 6 x 14-ft. Single-deck screens can be provided by merely removing the lower deck of the standard double-deck screen.

The advantages are enumerated as:

High Capacity: Greater amplitude at high speeds; unobstructed screening surface; true circle vibrating movement; controlled screen cloth tension.

Smooth Operation: Less than normal vibration through critical ranges in starting and stopping; minimum starting torque; screen can be suspended by cables or mounted on floor.

Low Maintenance: Easily serviced.

Among the materials which can be effectively sized are bone meal, cottonseed, dolomite, fertilizer, lime and limestone, phosphate rock.

Installation photographs, sizes, dimensions and other data are given in a new 16-page Link-Belt Book, No. 2154, a copy of which will be sent upon request to the company.

Gribbins Appointed to duPont Ammonia Post

The duPont Company has announced the appointment of Dr. M. F. Gribbins as a member of the Technical Service Section of the Ammonia Department to be concerned principally with development work relating to fertilizers and dairy and cattle feeds.

Dr. Gribbins has been a member of the Chemical Division of the Ammonia Department staff at the duPont Experimental Station since 1942. In his new work, he succeeds Dr. Frank G. Keenen who recently became assistant sales manager of the Nitrogen Products Section of the Sales Division.

Born September 26, 1916, in Tampa, Fla., Dr. Gribbins studied at the University of Miami where he received a bachelor of science degree in chemistry in 1938. He continued his studies, majoring in biochemistry, at The Pennsylvania State College where he received a master of science degree in 1940 and his Ph.D. in 1942. Soon afterward, he joined the duPont Company at the Experimental Station. As a senior technologist and a research chemist, he has been concerned principally with food research.

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FERTILIZER MATERIALS MARKET

NEW YORK

Demand for Fertilizer Materials Continues. Shortage of Boxcars Hinders Shipments of Mixed Fertilizers. Higher Prices on Sulphate of Ammonia Expected. Organic Materials Market Easier. Superphosphate Stocks Lower than Usual. New Potash Price Announced.

Exclusive Correspondence to "The American Fertilizer"

NEW YORK, May 12, 1947.

The demand for all basic fertilizer materials has continued unabated throughout the past reporting period. Shortages of mixed fertilizers are evident in some areas at this time, but the total supplies made available to agriculture this year will probably be in excess of all previous records. The continued difficulty in obtaining boxcars is the main contributing factor in not getting fertilizers to the farmers in time for spring application. It is to be noted that a third major producer of potash has recently announced price schedules for the coming fertilizer season. The basis announced is 45½c per unit K_2O f.o.b. producing point, with the company reserving the right to adjust in competition with other potash producers.

Sulphate of Ammonia

Shipments from the ovens to fertilizers mixers continue to increase, but demand has kept the present supply situation very tight. Rumors are becoming increasingly numerous in the trade that the new season will show higher prices for this material.

Nitrate of Soda

A shipment from Chile of approximately 4,000 tons arrived at this port within the past week. These additional supplies have temporarily eased the demand in this area, but fall far short of actually meeting requirements. It is expected that the allocation for imported material will be completed by June 1st. Domestic production continues to be short.

Organic Materials

This market is generally easier with the relaxing of buying interest by the feed trade. Dried blood, bone meal and fish meal are all weaker in tone but prices remain above the reach of most fertilizer manufacturers. There have been several imports from South America of blood and tankage, but the total has been very small and material moved to feeders.

Superphosphate

Stocks in producers' hands are considerably below those held at this time last year. The call from mixers continues strong, but due to the shortage of acid, production has been held down. Export inquiry for this material shows a decided decline due to the fact that most allocations to foreign countries have been fulfilled.

Potash

Heavy movement from the mines to mixers continues and considerable new buying interest is evidenced for spot delivery. Shipments from Fronce are arriving on schedule, and there is speculation as to how much foreign potash will be available for this market July forward.

PHILADELPHIA

Still Strong Demand for Fertilizer Materials. Demand for Feed Materials Slackens but Prices Remain Above Fertilizer Range

PHILADELPHIA, May 12, 1947.

Fertilizer chemicals are still in active demand with the spot supply rather short. While the mixing season is about ended, the planting season is several weeks behind normal. Organics are more plentiful with the demand very weak. The potash supply situation is easier.

Sulphate of Ammonia.—The supply position continues firm, and while distribution is in-

creasing, no additional prompt business is reported, and there is no accumulation of inventories.

Nitrate of Soda.—Arrivals from Chile are behind schedule, and the supply continues well below the requirements. The shortage for top dressing is relieved somewhat by the lateness of the season.

Castor Pomace.—There has been some buying interest at greatly reduced prices, but no offerings reported.

Blood, Bone, Tankage.—Demand for blood and tankage is practically nil, and producers are now hunting for outlets. The market is entirely nominal with blood quoted at $7.25 per unit of ammonia ($9.12 per unit N), and sales are said to have been made at well under this figure. Tankage has been offered at $6.50 per unit of ammonia, ($7.90 per unit N), with counterbids solicited. Bone is in limited demand, and it is suspected that stocks are accumulating in some sections. The feeding trade seems now to be almost entirely out of our market.

Fish Scrap.— Some future has been offered at slightly lower prices, but there is not too much buying interest apparent. There has been some demand for spot scrap, quoted at $2.00 per unit of protein ($10.28 per unit of ammonia or $12.50 per unit N), with meal correspondingly higher. This means feeding trade business, as price is definitely too high for fertilizer use.

Phosphate Rock.—Demand continues somewhat ahead of production capacity, but plant improvements and additions are under way to increase production facilities.

Superphosphate.—There is practically no accumulation of stocks and there is a ready market for all that is being presently produced.

Potash.—New prices for domestic potash are now pretty generally established. Prices are f.o.b. mines and seasonal discounts will be allowed. The supply situation is somewhat easier. More French potash has just been discharged at Norfolk and Savannah, and other arrivals are expected soon at these ports, as well as Baltimore. One or two of the southern States, however, are still short of their requirements. The production in France is said to be now at pre-war level.

CHICAGO

Fertilizer Organics in Demand for Future Delivery. Prices on Feed Materials Lower

CHICAGO, May 10, 1947.

More interest is being displayed for summer deliveries of organics and it appears now as though the market will remain steady to firm. Supply is none too plentiful and indications do not point to any improvement in that direction.

Demand for animal protein feeds has fallen off somewhat, resulting in lower prices being quoted on both unground tankage and unground blood. Both, however, are priced at above fertilizer values.

Fertilizer Still the Cheapest Farm Purchase

According to Clifton A. Woodrum, president of the American Plant Food Council, the April 15th price indexes issued by the U. S. Department of Agriculture show "fertilizer still is the cheapest item of expense on the farm, in relation to the average of all commodities used in agricultural production."

U. S. D. A.'s Bureau of Agricultural Economics in reporting April 15th indexes and ratios (1910–14 equals 100) lists all commodities used in farm production at 227

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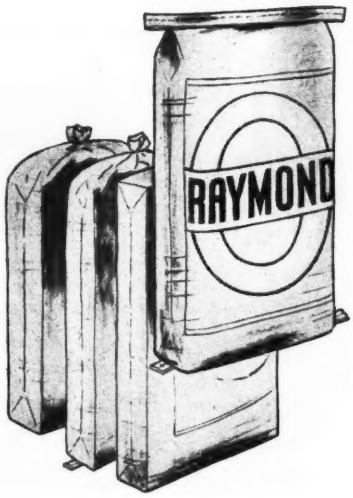

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which includes fertilizer at only 136, the lowest of all commodities used in production.

"The fertilizer industry is justly proud of its record of low prices, particularly in the face of rising costs of labor, plant-food materials, machinery, building supplies and other cost items which figure prominently in the production expansion program now under way to meet the requirements of farmers," Woodrum added.

"It is significant that over a period of years, fertilizer prices have been relatively favorable in relation to other commodities farmers have to purchase. In fact, the Bureau of Agricultural Economics' April report shows the five-year (1935–39) average for fertilizer at 100 compared with 127 for all commodities used in production during the same period."

BAE's indexes and ratios for April 15th lists all commodities for family maintenance at 255, or 132 points above the 1935–39 average while all commodities used in production on April 15th at 227 is exactly 100 points above the 1935–39 average.

Fertilizer averaged 100 for 1935–39 and today has increased only 36 per cent while all commodities used in farm production increased about 80 per cent during the same period.

Army Denies Destruction of German Fertilizer Plants

An erroneous press report of remarks made by former President Hoover recently led to discussion in the Senate about keeping in operation the fertilizer plants in Germany and to the introduction, by Senators Butler of Nebraska and Eastland of Mississippi, of a joint resolution on April 28th to prevent the dismantling of such fertilizer plants. The resolution was referred to the Committee on Armed Services.

However, on April 30th Senator Chan Gurney (R) of South Dakota, Chairman of the Committee on Armed Services, read to the Senate the following letter from Secretary of War Robert P. Patterson:

"In response to your request for a statement by the War Department concerning the question as to destruction of fertilizer plants in Germany, which has been recently discussed on the floor of the Senate, I submit the following information:

"Immediately upon publication of the newspaper stories that Mr. Hoover had stated to reporters that the Allies were destroying certain fertilizer plants in Germany, a verbatim quotation of the United Press story was radioed to General Clay and transmitted by him to General Keyes in Vienna. Radio replies from both have been received, the substance of which is as follows:

"First, as to Germany:

"(a) As to phosphate fertilizer: There has been no destruction of such plants, and none of the existing plants have or will be declared available for reparations. At present, phosphate fertilizer plant capacity totals 218,000 tons per year of P_2O_5. Of this, 59,000 tons is in the form of basic slag. Requirements for this type of fertilizer total 688,000 tons, leaving a deficit of 470,000 tons. In pre-war years, the basic slag production from the steel industry covered this deficiency.

"(b) As to potash: There has been no destruction of potash mines in the western zones. The Soviets have destroyed potash mines in their zones, but have stated to the Allied Control Council that the mines destroyed were exhausted and had been used for underground production of war materials by the Germans.

"(c) As to nitrogen fertilizer: There has been no destruction of synthetic-ammonia plants or any auxiliary fertilizer conversion plants in the western zones. Although syn-

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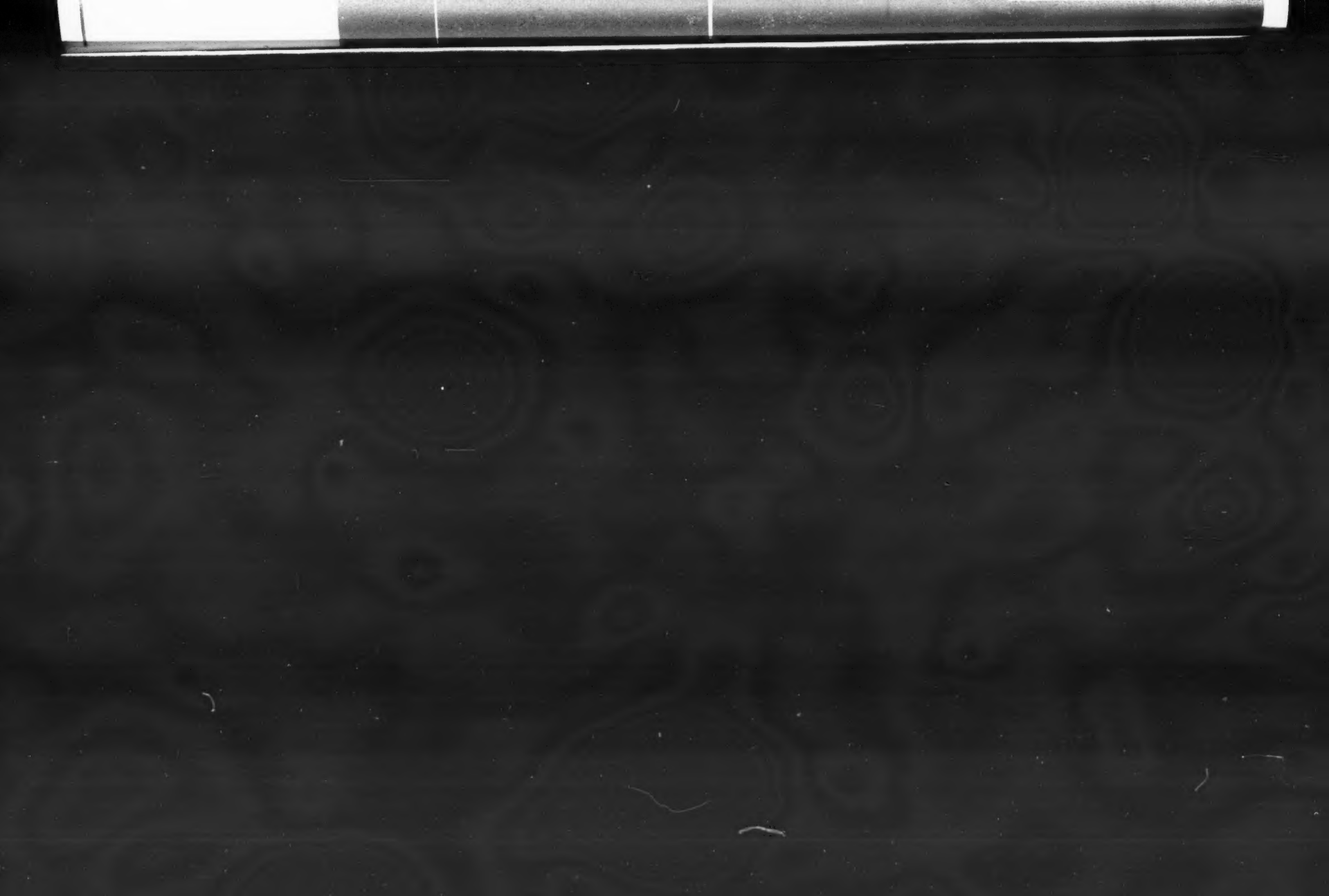

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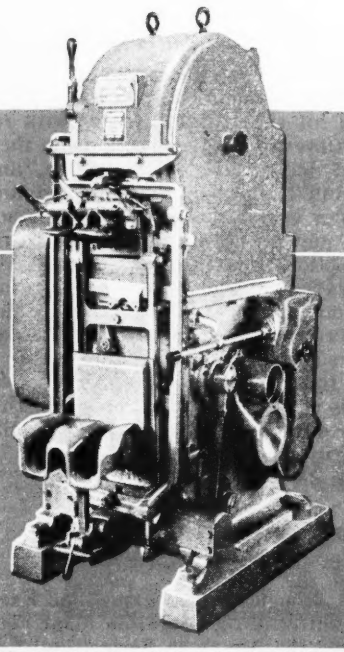

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thetic ammonia is listed as a prohibited industry, the Allied Control Council has authorized its production for German peace-time requirements until exports are sufficient to pay for all imports. Germany has plants sufficient for production of its nitrogen-fertilizer requirements, and deficiencies are due primarily to the basic shortages of coal and power.

"Second, as to Austria: The radio from General Keyes states that no fertilizer-producing plants in Austria have been or are being destroyed, nor are any contemplated for destruction or removal as a result of quadripartite action. The Austrian authorities have reported that sulphuric-acid production essential for manufacture of superphosphates has been largely eliminated by war damage or by removals by the Soviets.

"The fertilizer plants at Hoosbierbaum, part of which was destroyed by bombs, had a remaining annual capacity of 46,000 tons, and the plant at Pischelsdorf, which was lightly bombed', had a remaining capacity of 49,000 tons. These were both removed from Austria by Soviet order early in the occupation. The plant at Deutsch-Wagram, capacity 7,350 tons, was partially burned and production has been abandoned. The only remaining plant is at Liesing and has a capacity of 8,000 tons. This is under Russian management.

"Production of nitrogen in Austria depends upon obtaining sufficient coal from Germany or other sources to permit fuller operation of the plant at Linz, in the United States zone. This is now, because of lack of sufficient coal, producing at a rate of only 15,000 tons pure nitrogen per year. The full installed capacity of such plant is 60,000 tons. Austria's annual domestic requirements are 30,000 tons. All tonnages are given in metric tons of pur- nitrogen content.

"Relative to the story which the newspapers carried on or about April 18 concerning a statement by former President Hoover as to the destruction of fertilizer plants in Germany, Mr. Hoover has written me that the published account was incorrect. His letter stated that in the interview with reporters he complained 'of the Russian action with regard to fertilizers and other products in their zones in Germany, Austria, and Korea,' and that he 'stated that in the American and British zones every effort was being made within the imposed levels of industry to restore production of fertilizers.' However, Mr. Hoover says that he stated that 'the net result was that our tax-payers were being called upon to furnish fertilizers to countries formerly self-supporting, or even exporting a surplus of those commodities.' Mr. Hoover adds, in his statement to the reporters, that he 'warmly supported the efforts of our military authorities'."

Douglass Predicts Larger Fertilizer Production

Ralph B. Douglass, chairman of the Executive Committee of the American Plant Food Council, told the American Agricultural Editors Association on May 13th that "the fertilizer industry confidently expects new all-time records to be established in the production of nitrogen, phosphates and potash during the 1947–48 season." The Council was host to the Association members at a luncheon given in their honor.

Clifton A. Woodrum, who presided as president of the Council, described his organi-

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zation as "one with a positive and progressive educational program, dedicated to the service of American agriculture with an appreciation of the value of closer cooperation with Federal and State agencies and the agricultural press.

"Many of the Nation's agricultural editors played a major role in the writing of the aims and purposes of the Council," Mr. Woodrum added. "We continue to look to you for guidance in the field of agriculture."

Mr. Douglass in viewing the 1947–48 fertilizer outlook said that "fertilizer manufacturers already have more than doubled their pre-war production by expansion of facilities and the current unprecedented demands of farmers will be met just as rapidly as international controls can be relaxed, transportation bottlenecks can be broken and urgently needed machinery, steel for buildings and other materials can be obtained." He emphasized that "having a demand for fertilizer in excess of supply is, indeed, a rare experience for the industry."

Explaining that nitrogen, phosphates and potash are three of the most common plant foods in mixed fertilizer, he predicted that: (1) "Nitrogen for use in fertilizer next year will be approximately 10 per cent in excess of the amount used in 1946–47; (2) Barring strikes and transportation difficulties, we will have about a 10 per cent increase in normal superphosphate and a 25 per cent increase in triple superphosphate, or an overall increase in phosphates of approximately 12 per cent for the coming season; and (3) Slightly more potash for the 1947–48 period."

January-February Fertilizer Exports and Imports

Exports of fertilizers and fertilizer materials during the first two months of 1947 totaled 211,000 tons which is 6 per cent below the same period of 1946 but 127 per cent higher than January-February, 1945. The figures for the principal materials exported this year to February 28th were: sulphate of ammonia, 13,929 tons; nitrate of soda, 1,118 tons; other nitrogenous chemicals, 19,307 tons; phosphate rock, 105,487 tons; normal superphosphate, 32,988 tons; concentrated superphosphate 7,600 tons; muriate of potash, 17,499 tons.

Imports during January-February dropped from 351,920 tons in 1945 and 233,783 tons in 1946 to 128, 834 tons in 1947. The largest decline was in nitrate of soda of which 187,790 tons were received in January-February, 1945

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78,734 tons in 1946; and only 21,714 tons in 1947. Other imports were: sulphate of ammonia, 10,590 tons; ammonium nitrate mixtures 10,904 tons; cyanamide, 28,442 tons; ammonium phosphates, 11,192 tons; tankage, 1,199 tons; bone phosphates, 14,844 tons. No potash salts were imported during the first two months of 1947.

Ausley to Succeed Harris in P. C. A. Sales Organization

Potash Company of America has announced the resignation of Charles M. Harris, effective July 1, 1947.

Paul C. Ausley, Manager of the Southern Sales Office, Atlanta, Georgia, has been promoted to the position of Regional Sales Manager with headquarters at the General Sales Office in New York. He will be succeeded in Atlanta by W. H. Appleton, who for the past ten years has been sales representative in Alabama, Mississippi, Louisiana, Arkansas and Texas.

Mr. Appleton, in addition to his present territory, will handle sales in Georgia, Florida and Tennessee. He will be assisted in Florida by G. Albert Woods and in Georgia by J. Robert Mell.

T. E. Bradley, Manager of the Midwestern Sales Office, Peoria, Illinois, will be assisted by Myron M. Keim who will make his headquarters in Des Moines, Iowa.

Indiana Fertilizer Demonstration on Oats

Fifty-six Indiana farmers are conducting oats fertilization demonstrations in 52 counties this year after interest in this program increased farm operators observed results of similar field trials in 14 counties last year. The program is being directed cooperatively by county agricultural agents and extension agronomists of Purdue University.

The 1946 demonstrations were combine harvested. Average yields per acre were 56 bushels for the unfertilized plots and 71 bushels for those receiving 300 pounds of 3–12–12 fertilizer. The same amount of 0–12–12 fertilizer used in 12 of the trials produced an increase of five bushels per acre. The 12–12–12 fertilizer produced larger yields than the 3–12–12 in several trials but the heavier nitrogen rate caused lodging on some of the dark soils and tended to depress clover seedings. Eight of the trials were on dark colored soils.

Most of the 1946 trials were on varieties that are less stiff-strawed than are the Clinton and Benton varieties. These two new varieties are to be used in this year's trials, which will include an additional treatment with 6–12–12 fertilizer.

March Sulphate of Ammonia

The production of by-product sulphate of ammonia continued at peak levels, according to the figures of the U. S. Bureau of Mines. Output totaled 67,674 tons, compared with 61,298 tons in February and 61,187 tons in March, 1946. Shipments during March increased to 74,577 tons, which reduced stocks on hand at producing plants to 32,719 tons. Production for the first three months of the year came to 197,020 tons, an increase of 48 per cent over the same period of 1946. Indications are favorable for a continued high production, the only cloud on the horizon being a possible coal strike when the current contracts expire on June 30th.

	Sulphate of Ammonia	Ammonia Liquor
Production	Tons	Tons NH_3
March, 1947	67,674	2,471
February, 1947	61,298	2,165
March, 1946	61,187	2,291
Jan.–March, 1947	197,020	6,918
Jan.–March, 1946	133,286	6,005
Shipments		
March, 1947	74,577	2,279
February, 1947	56,401	1,919
March, 1946	64,203	2,199
Jan.–March, 1947	196,704	6,341
Jan.–March, 1946	144,814	5,832
Stocks on Hand		
March 31, 1947	32,719	835
February 28, 1947	40,080	817
March 31, 1946	20,610	668

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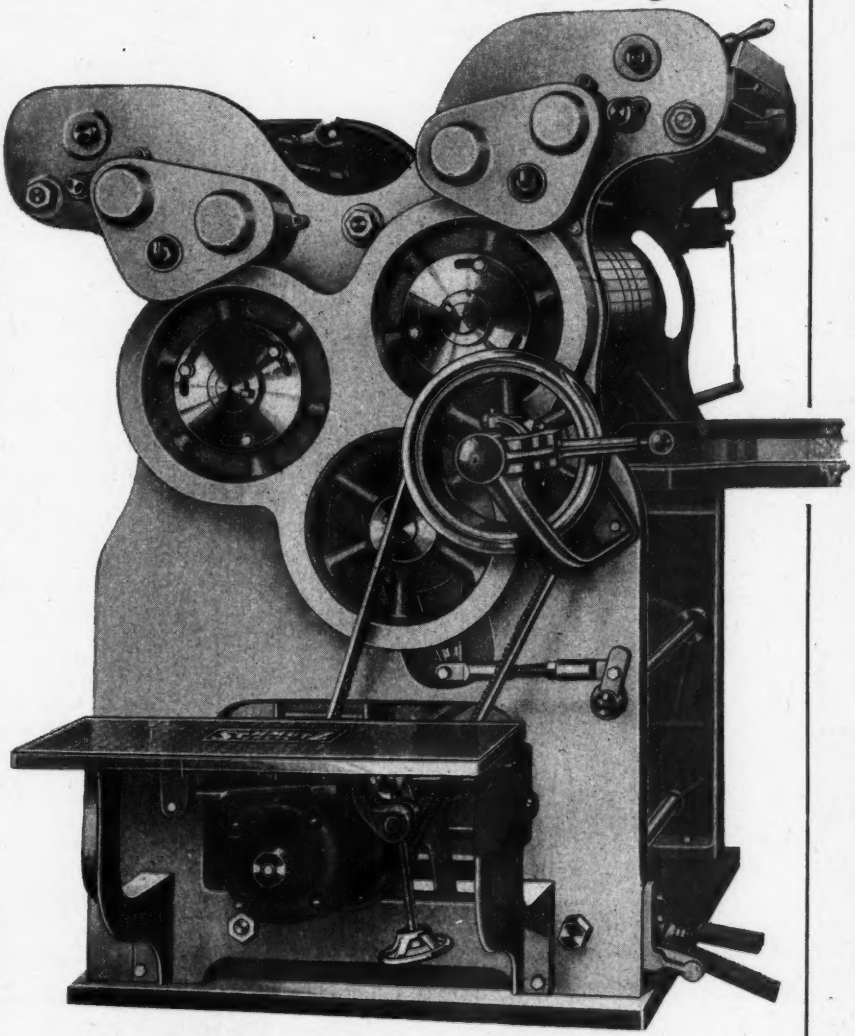

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Western Phosphate Rock

(Continued from page 11)

Phosphate rock operations in Utah in 1946 were confined to those of the Garfield Chemical and Manufacturing Corporation, Salt Lake City, Utah, which mined and shipped phosphate rock from a Federal lease near Springville, Utah County, for use in iron blast furnaces.

No phosphate rock was produced in Wyoming in 1946, nor were any mining operations in progress on the John M. Thomas and the John M. Thomas and Walker-Doerr Phosphate Company leases in the Sublette Ridge phosphate rock field in southwestern Wyoming.

The average value per ton of the Western States phosphate rock sold or used, as reported by producers to the Bureau of Mines, increased again in 1946—rising from $5.80 per ton in 1945 to $6.11 per ton in 1946. Increases were recorded in both Idaho and Montana, a 64-cent rise occurring in Montana.

The Problem of Filler in Fertilizers

(Continued from page 10)

age plant-food content of mixed fertilizers should be raised to about 23 per cent by elimination of most of the inert filler. An increased supply of high-analysis materials at favorable prices in the near future is probable. Therefore, further progress toward higher-analysis mixed fertilizers may be expected.

Regional Use of Filler

The average plant-food content of mixed fertilizers increased during the period 1934 to 1941 in all regions of the United States, except the Western, as may be seen in Table 2. It continued to increase in the Middle Atlantic, South Atlantic and South Central States, but decreased in the New England and Western Regions in 1945 as compared with 1941. The reasons for these differences between regions are due, primarily, to changes in the analyses and proportions of the materials used to supply nitrogen, phosphoric acid and potash, and secondarily, to the proportions of filler used in making mixed fertilizers.

In 1945 the following quantities of the various materials were used to make mixed fertilizers in the United States:

Material	*Tons*
Superphosphate	4,519,016
Muriate of potash	950,577
Sulphate of ammonia	779,488
Inert filler	597,213
Natural organics	527,597
Dolomite	475,000
Other potash	270,314
Ammonia and solutions	219,899
Other chemical nitrogen	194,084
Other phosphates	142,356
Secondary and minor element	125,000
Organic conditioners	70,000
Total	8,870,544

The first three materials above constitute 70 per cent of the total weight. In all parts of the country these three materials have about the same composition and make up the bulk of mixed fertilizers. Some of the other materials have a more localized usage. Most of the tonnage of organics is consumed in the Southeastern States and the Connecticut River Valley, especially in tobacco fertilizers. Relatively larger tonnages of double superphosphate and ammonium phosphate are consumed in the West and for this reason the West should have a total plant food higher than the national average and it has had for many years.

The highest average plant-food content is found in the New England Region. A large part of the fertilizer used in this region is consumed on potatoes and contains a very high proportion of potash. Inasmuch as the most economic potash material now available is 60 per cent muriate and much larger ratios of potash are used here, the total plant-food content should be high in this region. Nevertheless, that is only a part of the reason for the high average. The New England Region has done a superior job in getting rid of useless filler.

Filler has been more extensively used in the South than in other parts of the country. In 1934 mixed fertilizers in seven Southern States, Virginia to Mississippi, inclusive, contained 18 per cent of filler as compared to

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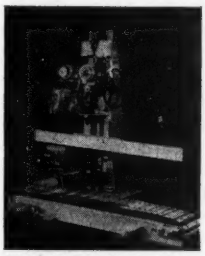

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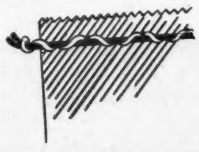

Here's a tough, safe bag closure— and it's easy to open!

11.4 per cent for the rest of the United States (*3*). Of the estimated 678,000 tons of filler used that year, 446,173 tons were used in North Carolina alone. As a result of the use of filler, the plant-food content of mixed fertilizers in the Southern States was lower than in any region, as may be seen in Table 2. Several of these States, however, have made very good progress in increasing the plant-food content of their fertilizers in recent years and in substituting dolomite for inert filler. Most low-analysis mixtures, 3–8–3, 4–8–4, and 3–9–3, have been replaced by grades containing 18, 20 or more per cent plant food, such as 4–12–4 and 5–10–5.

Currently the North Central States appear to be using more filler than necessary. The 2–12–6 grade constitutes about 60 per cent of the mixed fertilizer sold in this region. With the materials now available, from 250 to 500 pounds of filler or conditioner must be used to make this grade.

The addition of dolomite to mixed fertilizers for use in the North Central States is generally unnecessary and less desirable than in the case of goods to be used in the Atlantic and Gulf Coastal States. The need of conditioner is also less in the North Central Region than in areas using more hygroscopic mixtures.

TABLE 2.

THE WEIGHTED AVERAGE PLANT-FOOD CONTENT OF MIXED FERTILIZERS CONSUMED IN THE YEARS ENDED JUNE 30, 1934, 1941 AND 1945, BY REGIONS

Region	Plant Food	1934	1941	1945
		%	%	%
	N	5.12	5.85	5.86
	P_2O_5	9.18	10.38	9.57
New England	K_2O	9.22	11.42	11.49
	Total	23.52	27.65	26.92
	N	3.34	3.69	3.99
	P_2O_5	9.41	10.85	11.64
Middle Atlantic	K_2O	6.30	7.71	7.95
	Total	19.05	22.25	23.58
	N	3.25	3.69	3.75
	P_2O_5	8.53	8.47	9.00
South Atlantic	K_2O	4.25	5.61	6.56
	Total	16.03	17.77	19.31
	N	2.07	2.08	2.10
	P_2O_5	12.43	12.91	12.60
North Central	K_2O	6.55	8.55	9.12
	Total	21.05	23.54	23.82
	N	3.42	4.12	4.42
	P_2O_5	9.67	9.15	10.02
South Central	K_2O	4.47	5.06	5.85
	Total	17.56	18.33	20.29
	N	7.90	7.31	7.99
	P_2O_5	10.18	10.21	10.27
Western	K_2O	6.80	7.15	5.42
	Total	24.88	24.67	23.68
	N	3.38	3.67	3.77
	P_2O_5	9.26	9.77	10.37
Continental U. S.	K_2O	5.18	6.60	7.37
	Total	17.82	20.04	21.51

Economics of Filler

Vial (*12*) in 1932 made the first thorough analysis of retail price factors relating to fertilizers. This was followed by studies in this Department (*3, 5, 8, 9, 10, 11*). These studies show that the retail price of a mixed fertilizer is the wholesale cost of the materials required to make it, plus a more or less constant figure to cover manufacturing, bagging, and distribution costs, and profits. This figure is practically constant for all companies in a given State and year, but varies in different parts of the country and from year to year. The several estimates of the value of this constant part of the retail price vary around $14 a ton and this is the same for mixtures containing from about 16 per cent to 25 per cent of plant food. Shaw, Parker and Ezekiel (*11*) estimated it at $14.44 as an average for the period 1935 to 1941. Recently it has been about $16 per ton. Since the mixing, bagging and transportation costs are the same on filler as on plant food, Ross and Mehring (*9*) showed that the elimination of inert filler in 1934 would have reduced plant-food cost to the farmer more than would have been possible with a 50 per cent reduction in the wholesale cost of superphosphate.

Lockwood (*1*) gives the relative costs to the farmer of the same quantity of plant food in various fertilizer grades of the 1–2–2 ratio manufactured by the Eastern States Farmers Exchange. The relative costs to the farmer of 3–6–6, 4–8–8 and 5–10–10 fertilizers were 100, 79 and 68, and of the ingredients to make them 49, 44 and 37, respectively. These decreases in costs in going from the 3–6–6 to the 5–10–10 grade are due largely to elimination of filler.

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If the use of fillers had been reduced 50 per cent in 1945, about all that was technically feasible, the national fertilizer bill would have been reduced at least $8,000,000.

Educational Aspects of the Problem

The basic problem is to increase the average plant-food content of mixed fertilizers to the maximum limits consistent with the grades of materials now generally available and with the production of mixtures having satisfactory chemical and physical properties. This is essentially an educational problem. Many farmers are conservative and prefer to purchase fertilizers on a price-per-ton basis rather than on a unit plant-food cost. If they have used a 4–8–4 fertilizer for a long period of years, they do not readily understand why such a grade should be replaced by a 5–10–5 or 6–12–6 which costs more per ton. The need for educational work directed to farmers was shown in connection with efforts to eliminate uneconomic grades in the Carolinas. More opposition developed from farmers and in some instances from farm organizations than from other quarters.

The fertilizer industry, as represented by its trade associations, has rather consistently supported moves to reduce the use of fillers. Individual companies on occasions have opposed such moves. Generally speaking, neither the industry, the colleges, nor the farm organizations have done the effective educational work of which they are capable and which the problem merits. It is believed that rather good progress was made during the war period. This resulted in large degree from Federal-State action to standardize grades. In this process, most low-analysis grades that were sold in large tonnages were discontinued. Others, notably 2–12–6, 3–9–6, and 3–8–5, remain on the approved list in some States. They should be replaced by higher grades, such as 3–18–9, and 4–12–8.

Suggested Action

Fertilizer control officials, agricultural colleges, farmer organizations and the department can have great influence in solving the fertilizer filler problem. It is believed effective action would involve the following steps:

1. Conduct an educational campaign to have farmers purchase fertilizers on a unit plant-food cost rather than on a price-per-ton basis. This would involve clearly demonstrating the advantage of purchasing higher grade fertilizers.
2. Encourage progressive manufacturers, including farmer-owned co-operatives, to assume the leadership of the industry in the production and sale of higher grade fertilizers.
3. Work for the enactment of legislation for (a) The limitation of fertilizer grades to be offered for sale to a list approved by proper State authorities, and (b) Collection and publication of fertilizer grade tonnage data by six-month periods.
4. Continue to support research in fertilizer technology and fertilizer use.

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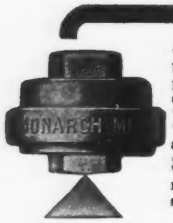

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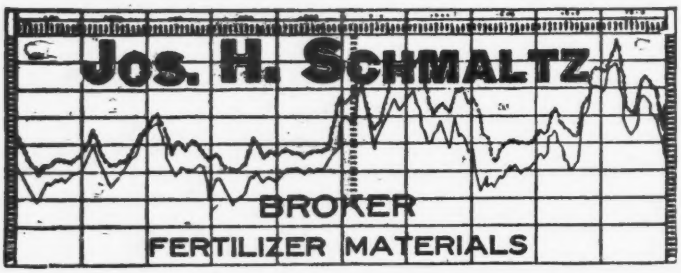

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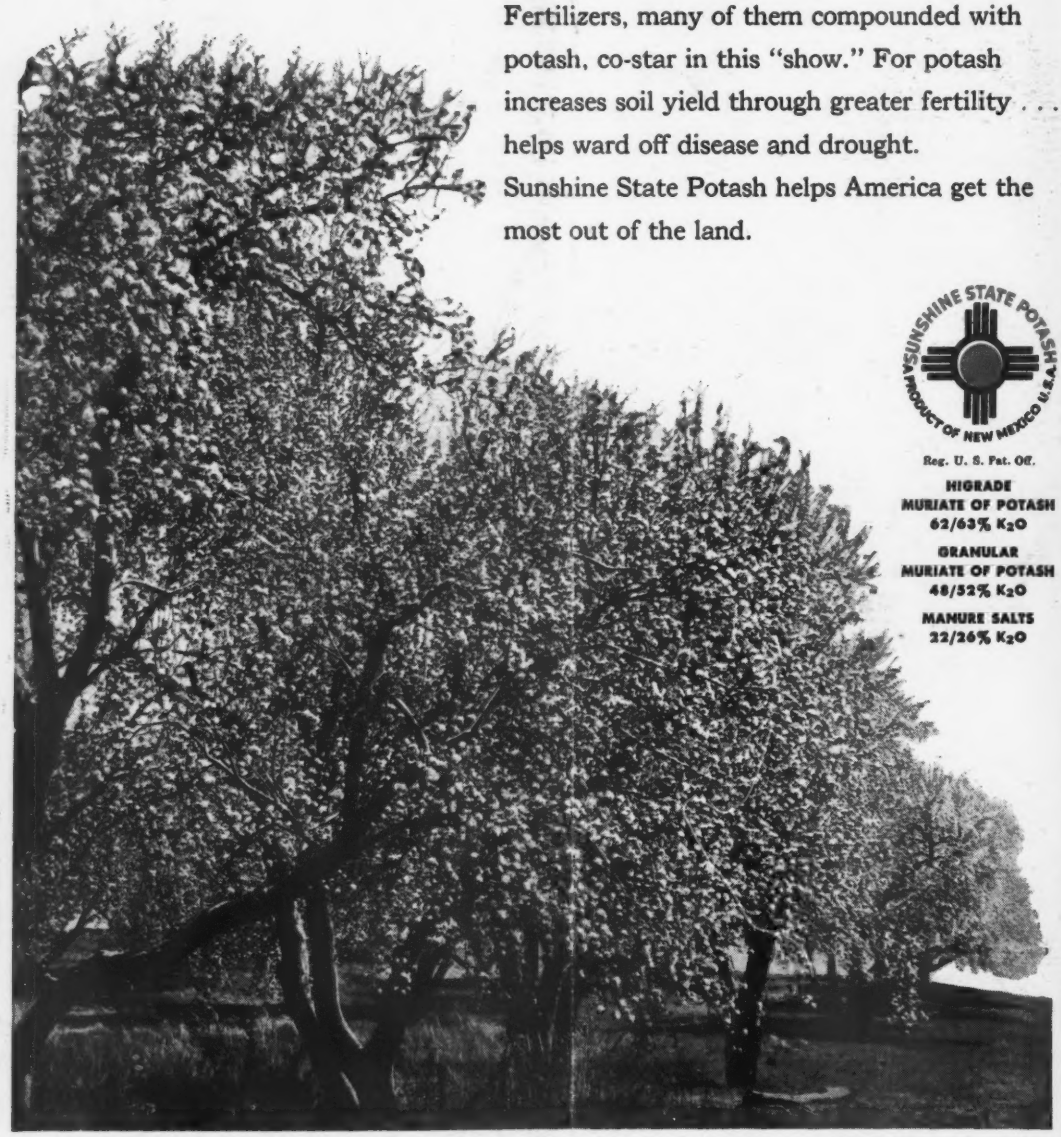

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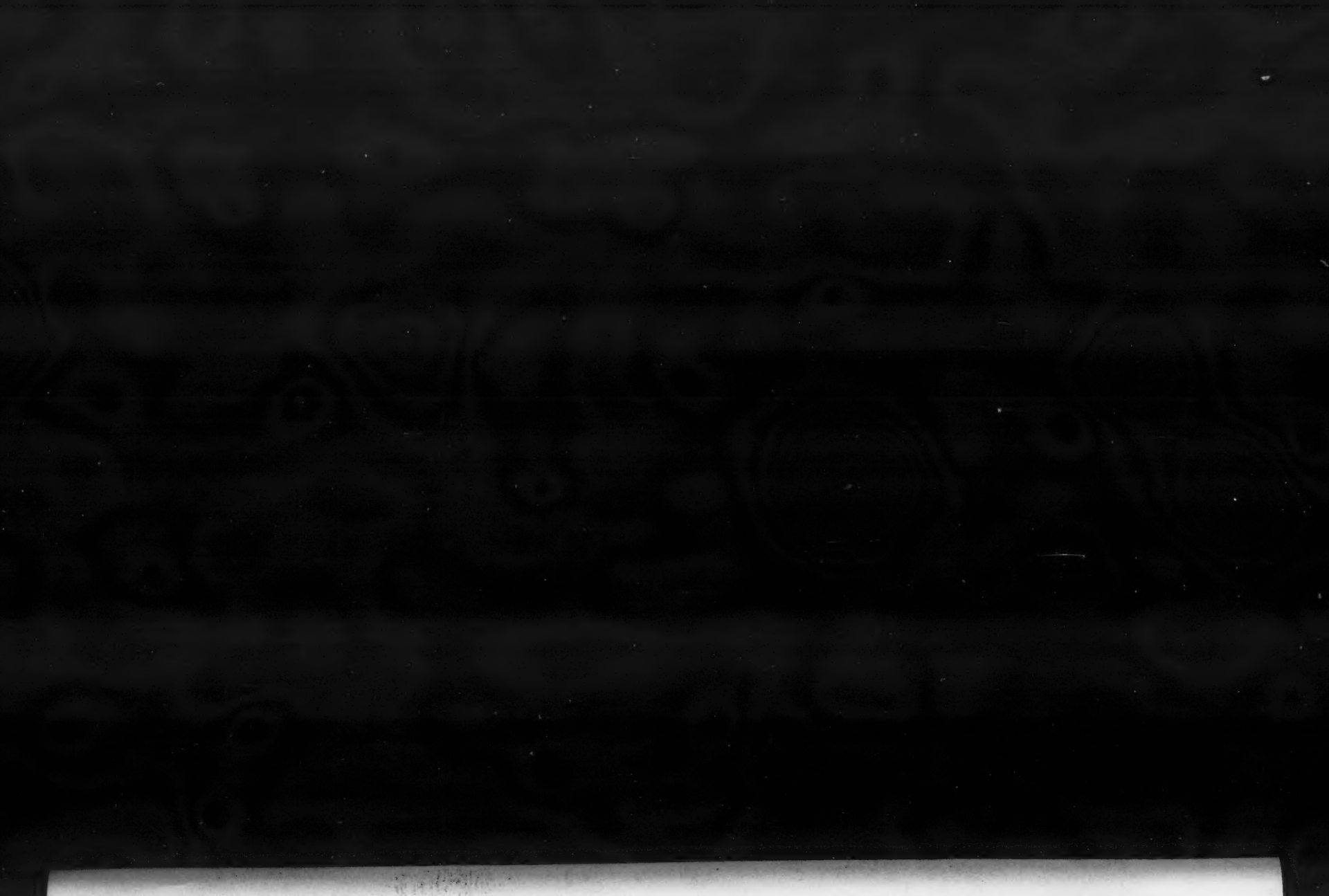
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